Publication No. 11-288812

Patent Document 3: Japanese Unexamined Patent Application Publication No. 2001-217124

Patent Document 4: Japanese Unexamined Patent Application Publication No. 2001-274016

Disclosure of Invention

Problems to be Solved by the Invention

It is an object of the present invention to improve the magnetization characteristics of a thin film magnet.

Means for Solving the Problems

The inventors of the present invention have conducted intensive research on the composition and the crystal texture for the purpose of improving the magnetization characteristics of the thin film magnet and, as a result, succeeded in the preparation of a thin film magnet having a nucleation type coercive force mechanism similar to that of the sintered magnet.

An aspect of the present invention is (1) an R-Fe-B based thin film magnet characterized by including an R-Fe-B based alloy which contains 28 to 45 percent by mass of R element (where R represents at least one type of rare-earth lanthanide elements), which has a film thickness of 0.2 to 400 μm, and which is physically formed into a film on a base material, wherein the R-Fe-B based alloy has a composite texture composed of $R_2Fe_{14}B$ crystals having a crystal grain

diameter of 0.5 to 30 μm and R-element-rich grain boundary phases present at boundaries between the crystals.

Another aspect of the present invention is (2) the R-Fe-B based thin film magnet according to the above-described item (1), characterized in that c axes, which are easy-to-magnetize axes, of $R_2Fe_{14}B$ crystals are oriented randomly or oriented nearly perpendicularly to a film surface.

Another aspect of the present invention is (4) a method for preparation of the R-Fe-B based thin film magnet according to the above-described item (1) or (2), the method characterized by including the step of heating the R-Fe-B based alloy to 700°C to 1,200°C during physical film formation or/and the following heat treatment, so as to grow crystal grains and form R-element-rich grain boundary phases.

In the case where the crystal texture of the Nd-Fe-B based thin film magnet is almost composed of $R_2Fe_{14}B$ crystals and the crystal grain diameter thereof is less than a single-magnetic-domain grain diameter corresponding to 0.3 μm, even when a magnetic field is applied, the magnetization direction of each crystal grain gradually rotates relative to the magnitude of the magnetic field and, thereby,